

#### US009543481B2

# (12) United States Patent

#### Pickett et al.

## (54) SEMICONDUCTOR NANOPARTICLE-BASED MATERIALS

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(\*) Notice: Subject to any disclaimer, the term of this

patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

0.5.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: 14/496,020

(22) Filed: Sep. 25, 2014

(65) **Prior Publication Data** 

US 2015/0048311 A1 Feb. 19, 2015

#### Related U.S. Application Data

(63) Continuation of application No. 12/888,881, filed on Sep. 23, 2010, now Pat. No. 8,847,197.

(Continued)

(30) Foreign Application Priority Data

Sep. 23, 2009 (GB) ...... 0916699.2

(51) Int. Cl. H01L 33/50 (2010.01) H01L 33/00 (2010.01) (Continued)

(52) U.S. Cl. CPC ............. H01L 33/502 (2013.01); C09K 11/025 (2013.01); C09K 11/565 (2013.01); C09K 11/70 (2013.01);

(Continued)

## (10) Patent No.: US 9,543,481 B2

(45) Date of Patent:

\*Jan. 10, 2017

#### (58) Field of Classification Search

CPC .... H01L 33/504; H01L 33/502; H01L 33/005; H01L 33/56; H01L 2933/0041; H01L 2224/48091; C09K 11/025; C09K 11/565; C09K 11/70; C09K 11/883

See application file for complete search history.

#### (56) References Cited

#### U.S. PATENT DOCUMENTS

2,769,838 A 11/1956 Matter et al. 3,524,771 A 8/1970 Green (Continued)

#### FOREIGN PATENT DOCUMENTS

AU 2009317049 A1 5/2010 CN 1394599 2/2003 (Continued)

#### OTHER PUBLICATIONS

International Search Report for PCT/GB2009/002605 mailed Feb. 22, 2010 (3 pages).

(Continued)

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### (57) ABSTRACT

The present invention relates to a primary particle comprised of a primary matrix material containing a population of semiconductor nanoparticles, wherein each primary particle further comprises an additive to enhance the physical, chemical and/or photo-stability of the semiconductor nanoparticles. A method of preparing such particles is described. Composite materials and light emitting devices incorporating such primary particles are also described.

#### 16 Claims, 6 Drawing Sheets

